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RESULTS MANAGEMENT

APPENDIX

MONTANA SAFETY

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APPENDIX I - SUPPORTING ANALYSES

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Appendix I-1

DEFINITIONS FOR COST BENEFIT ANALYSIS

COSTS We categorize costs as:

"FEE COSTS" are direct out-of-pocket costs paid by the motorist for the inspections and the additional government costs necessary to maintain the PMVI system.

DIRECT COSTS are fee costs plus the cost to the motorist to drive his vehicle to the inspection station. These costs include the cost to operate the vehicle and the costs to the motorist for his time.

TOTAL COSTS includes direct costs plus the estimated cost of PMVI generated repairs which otherwise would not have been necessary.

BENEFITS Potential benefits were calculated by applying the "certain" involvement factor of vehicles (6%) in highway crashes times the total cost (1974) of such crashes. The total cost was calculated using NSC (National Safety Council) costs and NHTSA costs. (See I-3) This figure constitutes the benefit IF the PMVI program were 100% effective. (Note the "probable" factor of 16% for vehicles was not used to calculate benefits because the "certain" involvement of human factors was 85% and environmental factors was 18%.

EFFECTIVENESS REQUIRED TO BREAK EVEN To determine what our expectation of effectiveness must be to return dollar for dollar benefit for cost, we calculated the "break even" point.

ANALYSIS OF POTENTIAL PMVI EFFECTIVENESS

VEHICLE SYSTEM COMPONENT	CERTAIN PERCENT INVOLVEMENT * ALL CRASHES	CERTAIN VEHICLE FACTOR CRASHES	CERTAIN EFFECTIVENESS EXPECTED (**)	CERTAIN CONTRIBUTION TO EFFECTIVENESS (***)	PROBABLE PERCENT INVOLVEMENT * ALL CRASHES	PROBABLE VEHICLE FACTOR CRASHES	PROBABLE EFFECTIVE-NESS EXPECTED (**)	PROBABLE CONTRIBUTION TO EFFECTIVENESS (***)
Brakes	4%	66%	.50	.33	6%	40%	.50	.20
Tires	0%	0%	0		4%	27%	.25	.07
Inadequate	0%	0%	0		2%	13.5%	.50	.07
Under Inflated	0%	0%	0		2%	13.5%	0	0
Steering	1%	17%	.50	.09	2%	13%	.50	.07
Body & Doors	1%	17%	0		1%	7%	0	. 0
Communications	0%	0%	0		2%	13%	.50	.07
TOTAL	6%	100%		.42	15%	100%		.41

* Indiana University Study 8/73 DOT-HS-800-902 Phase 11, Level Causal data

** Assumed for comparative purposes. NHTSA uses a 45% - 75% effectiveness based on "state data" i.e. Nebraska & Texas.

*** Vehicle Factor crashes percent times "expected" effectiveness.

This analysis shows the vehicle component involvement in crashes both for the "certain" category and the "probable" category. We are showing an effectivenss expected for each component. The main purpose of this analysis is to show certain of the vehicle system components probably cannot be influenced by PMVI -- e.g. under inflated tires and body doors.

CALCULATION OF BENEFITS

There are two authorities concerning the "cost" or loss from traffic crashes. These are NHTSA (National Highway Traffic Safety Administration Department of Transportation) and NSC (National Safety Council). The cost figures for each are:

COST OF MOTOR VEHICLE ACCIDENTS

	1971 NHTSA	1973 NSC
Average Loss per Fatality	$200,000	$90,000
Average Loss per Injury	7,200	3,700
Property Damage Only Loss	300	500

We have included in the cost/benefits analyses both authorities. In our opinion, however, program justification must be made in terms of the NSC figures, since the NSC figure more closely represents economic realities. (see, p. 22 April, 1973 issue of Traffic Safety)

Following is a comparison of the calculations.

	Billing of Dollars NSC	NHTSA
1 Pain & Suffering	not used	3.8
2. Home & Family duties	not used	4.3
3. Service to Community	not used	1.0
4. Wage Loss	3.7	18.0
5. Medical Costs	1.1	2.0
6. Property Damage	5.0	7.2
7. Insurance Adm. & Claim Costs	6.0	6.6
8. Other (includes funderal costs assist depreciation, etc.)	not used	3.1
	15.8	46.0

Appendix I-4

CALCULATION OF COST FOR ANNUAL PMVI

	INTERIM VIU	FULL VIU
Average Time/Inspection (1)	30 minutes	45 minutes
Labor Cost (Hour $4.03 + 16% Burden) (2)	$ 2.34	$ 3.51
(Burden = Taxes & Insurance = 10% Vacation, non-productive time 6%)		
Maximum number of inspections (vehicles/12 hr. day)	24	16
Average daily number of inspections (3) using loading factor of 60% of maximum	14	10
Facilities required for 523,593 (4)	140	190
Facility Cost (yearly) (5)		
Rent 160 Sq. Ft. x $1.50 (6)	$ 240	$ 240
Utilities	60	60
Total Facility Cost	$ 300	$ 300
Facility Cost/Vehicle (7)	$ .08	$ .11
Labor Cost	2.34	3.51
Administration & Profit (8)	.46	.69
Total Cost to Inspection	$ 2.88	$ 4.31

Information Sources:

(1) (See I-14)
(2) Average hourly wage in state.
(3) Used in NHTSA cost/benefit study.
(4) Number of vehicles auto registration (1974) + 153,087 trucks under GVW #8000.
(5) 523,593 vehicles ÷ yearly capacity, plus 20 additional facilities to insure a minimum of one facility per county.
(6) Federal Energy Administration estimated minimum.
(7) 140 (or 190) facilities per year x $300 ÷ number of vehicles.
(8) Administration estimated to be 6% of total cost and profit 10% of total cost.

Appendix I-5

COST BENEFIT ANALYSIS

MONTANA P.M.V.I.

PER VEHICLE UNIT COSTS

	Annual Inspection/ Yearly Cost		Inspection Once in Four Years/Yearly Cost	
	INTERIM VIU	Final VIU	Interim VIU	Final VIU
COST TO INSPECT (See I-4)	$ 2.88	$ 4.31	$ .70	$ 1.08
STATE ADMINISTRATION COSTS (See I-12)	$ .41	$ .41	$ .41	$ .41
FEE COST	$ 3.29	$ 4.72	$ 1.11	$ 1.49
TIME COST (See I-13)	$ 4.03	$ 5.04	$ 1.01	$ 1.26
TRAVEL COST (See I-13)	$ 2.04	$ 2.04	$ .51	$ .51
DIRECT COST	$ 9.36	$11.80	$ 2.63	$ 3.26
"Extra" REPAIR COSTS (see I-13)	$ 3.06	$ 3.06	$ .77	$ .77
TOTAL COST	$12.42	$14.86	$ 3.40	$ 4.03

TOTAL PROGRAM COST * - ($1,000's)

FEE COSTS	$1,723	$2,471	$ 581	$ 780
DIRECT COSTS	$4,901	$6,178	$1,377	$1,707
TOTAL COSTS	$6,503	$7,781	$1,780	$2,110

*For 523,593 Vehicles

EFFECTIVENESS NEEDED TO BREAK EVEN

	INTERIM VIU			FINAL VIU		
	Fee Cost	Direct Cost	Total Cost	Fee Cost	Direct Cost	Total Cost
NSC	.45	1.29	1.71	.65	1.63	2.05
NHTSA	.23	.66	.88	.33	.83	1.05

BENEFIT CALCULATION (Total Program Costs ÷ Potential Benefit)

Total Cost of Highway Crashes (See I-11)

NSC $63,208.00 x 6% Involvement produces $3,792,000 Potential Benefit
NHTSA $123,725.00 x 6% Involvement produces $7,424,000 Potential Benefit

COST/BENEFITS RATIO produced by .5 effectiveness of PMVI

	INTERIM		FINAL	
	Fee Cost	Direct Cost	Fee Cost	Direct Cost
NSC	.91	2.58	1.30	3.26
NHTSA	.46	1.32	.67	1.66

	1723/3792 = .45	4901/3792 = 1.29	6503/3792 = 1.71
	2471/3792 = .65	6178/3792 = 1.63	7781/3792 = 2.05
	1723/7424 = .23	4901/7424 = .66	6503/7424 = .88
	2471/7424 = .33	6178/7424 = .83	7781/7424 = 1.05
INTERIM	(3792 x .5) = 1896	1723/1896 = .91	4901/1896 = 2.50
	(7424 x .5) = 3712	1723/3712 = .46	4901/3712 = 1.32
FINAL		2471/1896 = 1.30	6178/1896 = 3.26
		2471/3712 = .67	6178/3712 = 1.66

Appendix I-6

CALCULATION OF LIVES SAVED

YEAR	MILLION VEHICLE MILES*	PROJECTED DEATH RATE	* * DEATHS	ACTUAL DEATHS*	LIVES SAVED ***
1967	4234	6.96	283	319	-36
1968	4150	7.06	293	289	4
1969	4439	7.17	318	339	-21
1970	4867	7.28	354	318	36
1971	5079	7.39	375	328	47
1972	5373	7.49	402	395	7
1973	5689	7.60	432	323	109
1974	5823	7.71	449	299	150
	TOTALS		2906	2610	296

* Source: Fact Sheet

** Based on Trend 1959-1966 ($y=ax+b$ if $a=.1074$ and $b=-204.3$ and $x=$year, then $y=$projected deaths)

*** Projected deaths less Actual deaths

Appendix I-7

CALCULATION OF INJURIES PREVENTED

YEAR	MILLION VEHICLE MILES*	PROJECTED** INJURY RATE	PROJECTED** INJURIES	ACTUAL* INJURIES	INJURIES*** PREVENTED
1967	4234	195.23	8266	7895	371
1968	4150	209.92	8712	7868	844
1969	4439	224.61	9970	8101	1869
1970	4867	239.30	11647	8449	3198
1971	5079	253.99	12900	9015	3885
1972	5373	268.68	14436	9090	5346
1973	5689	283.37	16121	8446	7675
1974	5823	298.06	17356	8463	8893
	TOTALS		99,408	67,327	32,081

* Source: Fact Sheet

** Trend 1959-1966 (y=ax=b if a=14.69 and b-2870 and x=year, then y=projected injuries)

*** Projected injuries less Actual Injuries

Appendix I-8

CALCULATION OF ACCIDENTS PREVENTED

YEAR	PROJECTED ACCIDENTS(1)	ACTUAL ACCIDENTS(2)	ACCIDENTS PREVENTED(3)
1967	18,242	15,734	2508
1968	19.568	15,669	3899
1969	20,894	17,683	3211
1970	22,220	15,276	6944
1971	23,546	18.247	5299
1972	24,872	16,259	8613
1973	26,198	15,788	10410
1974	27,524	15,760	11764
TOTALS	183,064	130,416	52,648

(1) Trend 1959-1966
(y=ax+b, if a=1326 and b=-2,590,000 and x=year, then y=projected accidents)

(2) Fact Sheet, reported accidents

(3) Projected minus actual

Appendix I-9

ANALYSIS OF COST EFFECTIVENESS - ACCIDENT PREVENTION UNIT

EFFECTIVENESS: Reduction in Accident rates (1) 22%

Length of time of residual effect of APU (1) 2.3 months

Effectiveness Measure $\frac{22\% \times 2.3 \text{ months}}{12 \text{ months}}$ = 4.2% yearly basis

TOTAL BENEFITS: (1974)

NHTSA Valuations	(2)	4.2%	x $123,725,000	$5,196,000
NSC Valuations	(2)	4.2%	x $ 63,208,000	$2,655,000

COST OF APU PROGRAM:

5 Teams x 5 Men x $24,147/Man-Yr (3) $603,687.50

COST/BENEFITS:		RATIO
NHTSA Values	Cost- 603,688 / Benefits- 5,196,000	$ .12/$1.00
NSC Values	Cost- 603,688 / Benefits- 2,655,000	$ .23/$1.00

(1) ITRS page 2.18 (This analysis is based on a study of the APU effectiveness on US 93.)

(2) Appendix I-11

(3) First Year $27,904 (includes vehicle) Second Year $20,361 Average = $24,147.50 as supplied by Highway Patrol (7/25/75)

Appendix I-10

ANALYSIS OF COST EFFECTIVENESS - SPOT IMPROVEMENT

EFFECTIVENESS:	Reduction in Economic Loss (yearly)	(1)	$ 39,352

COST OF SPOT IMPROVEMENTS:

Construction to obtain above benefits	(1)	$ 217,521
Amortize Cost over estimated 20 year useful life	(2)	$ 10,876

			RATIO
COST/BENEFITS	Costs -$10,876	$	.28/$1.00
	Benefits-$39,352		

(1) ITRS page 2.21

(2) Generally accepted minimum estimate of highway improvement life.

Appendix I-11

MONTANA

COST OF TRAFFIC CRASHES - 1974

1974 Statistics		NHTSA*		NSC **	
		Unit Cost	Total Cost	Unit Cost	Total Cost
FATAL	299	x $200,000	$59,800.000	x 90,000	$26,910,000
INJURY	8463	x 7,200	60,934,000	x 3,700	31,313,000
PROPERTY DAMAGE ONLY	9969	x 300	2,991,000	x 500	4,985,000
			$123,725,000		$63,208,000

*Societal Costs of Motor Vehicle Accidents US DOT, NHTSA
April 1972

**National Safety Council

Appendix I-12

State Administration Costs for
PMVI

VII. Administrative Costs

A. Personnel	
1. Administrator	$14,000.00
2. Clerk/Typist	6,000.00
3. Data Clerks (5 @ 7,000.00)	35,000.00
4. License Agents (5 @ 9,000.00)	45,000.00
5. Employee Benefits	13,500.00
6. Travel & Per Diem	10,000.00
B. Contracted Services	
Licenses (650,000 @ 4¢ each)	26,000.00
Training	10,000.00
C. Commodities	10,000.00
D. Other Direct Costs	
Building (2500 sq. ft. @ $4.75)	11,875.00
Equipment	12,000.00
Data Processing	20,000.00
Total First Year	$213,375.00

Cost per inspection $ .41

($213,375 ÷ 523,593 vehicles)

Appendix I-13

Supporting Analysis for PMVI Costs

TIME COSTS

The average passenger car trip in Montana was approximately 13.62 miles. Assume this requires one-half hour. The motorist will wait also for the inspection so the time cost will be 1 hour times the average wage of $4.03 for the interim inspection and one and one-fourth hours or $5.04 for the Final VIU.

TRAVEL COST

13.62 miles + 15¢/mile operating cost (allowed by IRS) or $2.04.

EXTRA REPAIR COSTS

Estimate based on New Jersey study by R.W. McMinn "Using Accident Research to Evaluate Periodic Motor Vehicle Inspection" (8/73). Estimate based on Table 2 Repair Costs of $30.60 and assumption 10% were "extra" or unnecessary.

Analysis of Inspection Times

"I would expect that your system could be handled by one man in about 25 minutes." Opinion of R. W. McMinn, State of New Jersey.

Inspection Times: (Table 7 Lane Facility)

Minimum Safety	10 minutes lane time	_____labor time
	12 minutes lane time	_____labor time
	18 minutes lane time	_____labor time
	24 minutes lane time	_____labor time

It should be reasonable to complete the emphasis standards with other safety checks in 15 to 20 minutes.
(paper by NHTSA F. Grenia 3/11/75)

Study by Allen R. Toftely 56 minutes consisting of

A	Visual Unlifted Category	16 minutes
B	Operational Unlifted Category	12 minutes
C	Mechanical Unlifted Category	13 minutes
D	Mechanical Lifted Category	15 minutes

The Director of the state motor pool supplied the time estimate used which in light of other information appears reasonable.

DCA